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COMPARATIVE SPINNING TESTS OF SUPERIOR VARIETIES OF COTTON (GROWN UNDER WEEVIL CONDITIONS IN THE SOUTHEASTERN STATES; CROP OF 1921)

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PURPOSE OF TESTS.

The spinning tests herein described were conducted to determine the relative spinning value of cotton commercially thought to be of superior character with that of a number of pure strains of superior varieties of cotton. All were grown under boll-weevil conditions in the southeastern cotton States during the season of 1921.[1]

IMPORTANCE OF PURE VARIETIES.[2]

Pure stocks of cotton seed produce larger and better crops because all of the plants in the field are alike, while in mixed stocks many of the plants are degenerate and unproductive and the lint is mixed and therefore of mediocre value. The use of pure seed means larger crops and better fiber.

The fiber from pure stocks is better not only because of its greater length or strength, but also because the fibers are more uniform, which is the first essential of high quality in cotton fiber.

Good cultural conditions simply give pure seed an opportunity for the expression of the full possibilities of the variety.

By superior varieties we do not necessarily mean long staples. There are superior short staple varieties as well as superior long staple varieties. Superiority consists of uniformity—uniformity of plants, uniformity of fruiting habit and of fruit; all of which results in uniformity in the length and in the character of the cotton, the most valuable spinning qualities to be had.

Pure seed is the first essential to a superior fiber.

[1] These spinning tests were conducted under the general supervision of William R. Meadows, cotton technologist, and under the direct supervision of William G. Blair, specialist in cotton testing, who was assisted by H. B. Richardson, C. E. Folk, and E. S. Cummings, assistants in cotton testing. The tests were made in the textile department of the Clemson Agricultural College, Clemson College, S. C.

[2] From a paper read by G. S. Meloy, investigator in cotton marketing, at the conference of the cotton division, New Orleans, La., June 23, 24, 25, 1920.

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VARIETIES OF COTTON TESTED.

The following varieties were tested: Acala, Lone Star, Mexican Big Boll, Rowden, and typical North Georgia. All of the cotton was obtained from men of reputation for their plant-breeding work, with the exception of the typical North Georgia cotton, which was bought from a prominent cotton merchant as typical "North Georgia" cotton. This type of cotton always commands a premium over other cotton of the same grade and length of staple.

ORIGIN OF THE COTTON.

The Acala cotton consisted of 7 bales grown near St. Clair, Lowndes County, Ala.; the Lone Star consisted of 4 bales grown near Fayetteville, N. C.; the Mexican Big Boll consisted of 4 bales grown near McFarland, N. C.; the Rowden consisted of 4 bales grown near Monroe, N. C.; and the typical North Georgia cotton consisted of 4 bales bought from a merchant in Athens, Ga. The exact origin or history of the typical North Georgia cotton is unknown, except that it came from that region known commercially as typical "North Georgia" territory.

CLASSIFICATION OF THE COTTON.

Samples of cotton from the different bales were classed by a committee of the board of examiners. This committee is authorized to class cotton at the future exchanges under the provisions of the United States cotton futures act. The results of this classification are shown in Table 1.

TABLE 1.—*Classification of the cotton of the different varieties.*

Variety.	Grade.	Length of staple.	Variety.	Grade.	Length of staple.
		Inches.			*Inches.*
Acala	Middling	1	Mexican Big Boll	Strict Middling	1
	Middling	1 1/16		Good Middling	1
	Middling	1 1/16		Good Middling	1 full.
	Middling	1 1/16		Good Middling	1 1/16
	Middling	1 1/16 full.	Rowden	Good Middling	1 full.
	Middling	1 1/16 full.		Good Middling	1 1/16
	Strict Middling	1 1/16 full.		Good Middling	1 1/16
Lone Star	Middling	1 1/16		Good Middling	1 1/16
	Middling	1 1/16	Typical North Georgia	Strict Middling	1 full.
	Strict Middling	1 1/16		Strict Middling	1 1/16
	Good Middling	1 1/16		Strict Middling	1 1/16
				Strict Middling	1 1/16

MECHANICAL CONDITIONS.

The five different varieties of cotton were run under identical mechanical conditions, which conformed to common mill practices for the grade and length of staple used.

PERCENTAGES OF WASTE.

Accurate weighings were made of the net amount of cotton fed to and delivered by each cleaning machine and of the net amount of waste discarded by each. From these weighings the percentage of visible, invisible, and total waste were determined. The percentages of waste for each variety are shown in Table 2.

TABLE 2.—*Percentages of waste from the different varieties of cotton.*

	Acala.	Lone Star.	Mexican Big Boll.	Rowden.	Typical North Georgia.
Grade	Mid.	S. M.	G. M.	G. M.	S. M.
Length of staple (inches)	1 1/16	1 1/16	1 full	1 1/16	1 1/16
Picker waste: [a]	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Opener-breaker motes and fly	1.31	1.26	.86	.86	.74
Finisher motes and fly	1.44	1.11	.91	.80	.85
Total visible	2.75	2.37	1.77	1.66	1.59
Invisible	.68	.54	1.03	1.21	1.03
Total visible and invisible	3.43	2.91	2.80	2.87	2.62
Card waste: [b]					
Flat strips	2.70	2.58	2.51	2.32	2.30
Cylinder and doffer strips	1.02	.98	1.00	.73	.86
Motes and fly	1.96	1.65	1.47	1.32	1.60
Sweepings	.05	.11	.10	.07	.07
Total visible	5.73	5.32	5.08	4.44	4.83
Invisible	.83	.12	.29	.83	.47
Total visible and invisible	6.56	5.44	5.37	5.27	5.30
Pickers and cards: [a]					
Total visible	8.28	7.54	6.71	5.97	6.29
Total invisible	1.48	.65	1.31	2.02	1.49
Total visible and invisible	9.76	8.19	8.02	7.99	7.78

[a] Based on net weight fed to bale-breaker. [b] Based on net weight fed to cards.

Table 2 shows that the percentages of total visible waste discarded by the different varieties of cotton, closely followed the grade when comparing the pure strains of cotton.

MOISTURE CONDITIONS.

The different varieties were run under as nearly identical moisture conditions as possible. Outside weather conditions caused higher relative humidities in the picker and card rooms than were desired. A relative humidity of 50 per cent was desired in the picker room, 60 per cent in the card room, and 70 per cent in the spinning room. Actual conditions which prevailed while the cotton was being machined are shown in Table 3. These averages were obtained from readings of self-recording hygrometers equipped with electric fans.

TABLE 3.—*Average temperatures and relative humidities during tests.*

Process.	Acala.		Lone Star.		Mexican Big Boll.		Rowden.		Typical North Georgia.	
	Temp.	Rel. hum.	Temp.	Rel. hum.	Temp.	Rel. hum.	Temp.	Rel. hum.	Temp.	Rel. hum.
	°F.	*Per cent.*	°F.	*Per cent.*	°F.	*Per cent.*	°F.	*Per cent.*	°F.	*Per cent.*
When opened	77	78	76	67	85	67	83	70	80	71
Finisher picker	79	71	77	73	84	65	79	69	82	69
Cards	77	61	81	65	83	62	84	64	84	62
Drawing frames	77	60	82	62	83	62	84	65	84	62
Roving frames	78	66	83	64	80	61	83	62	85	64
Spinning frame	84	71	85	71	86	70	86	70	86	70

Samples for moisture tests were obtained at different periods during the day from the different manufacturing processes. The averages of these moisture tests are shown in Table 4.

TABLE 4.—*Percentages of moisture regain in cotton at the different manufacturing processes.*

Sample.	Acala.	Lone Star.	Mexican Big Boll.	Rowden.	Typical North Georgia.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
From bale	7.78	7.81	8.47	8.78	9.20
Finisher picker lap	7.52	7.64	7.87	6.92	8.78
Lap from back of card	7.01	7.36	7.42	7.10	8.21
Card sliver	6.74	6.90	7.10	6.84	7.71
Finisher drawing sliver	6.66	7.12	7.27	6.38	7.61
Fine frame roving	6.96	6.97	6.62	6.62	7.25
Fine frame roving from creel of spinning frame	7.47	7.25	7.31	7.27	7.40
Yarn from spinning frame	7.84	7.64	7.38	7.48	7.53

The difference between the percentage of moisture in the bale and in the card sliver corresponds closely with the total percentage of invisible waste obtained from the pickers and cards.

Whenever cotton in process is subjected to a given relative humidity and temperature for two hours or more, the cotton assumes the moisture regain of that relative humidity and temperature.

The variation in moisture regain of the varieties is due to the different hygroscopic properties and the moisture in the bale of each variety.

Therefore, the differences in the moisture content (see Table 4) of the finisher picker lap and the lap from the back of the card, and the fine frame roving and the fine frame roving from the creel of the spinning frame are accounted for by the fact that the relative humidity of the picker room averaged 70 per cent, the card room 60 per cent, and the spinning room 70 per cent.

BREAKING STRENGTH OF YARNS.

The cotton of each variety was spun into 28's, 36's, and 44's yarn with twists equal to 4.25, 4.50, and 4.75 times the square root of the number spun. The average breaking strengths are shown in Table 5. These averages have been corrected for slight variations in the sizings of the yarn.

TABLE 5.—*Breaking strength in pounds per skein of 120 yards of yarn spun from the different varieties of cotton.*

No. of yarn.	New Draper Standard.	Twist multiplier.	Acala.	Lone Star.	Mexican Big Boll.	Rowden.	Typical North Georgia.
	Pounds.		*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
28's	69	4.25	71.4	62.6	68.1	64.4	57.2
		4.50	71.2	62.9	67.2	62.9	56.2
		4.75	68.8	61.3	66.3	63.1	55.9
		Average.	70.5	62.3	67.2	63.5	56.4
36's	54	4.25	50.6	45.6	48.6	44.6	40.5
		4.50	50.4	43.7	46.8	44.0	39.9
		4.75	48.7	43.8	46.4	42.6	39.8
		Average.	49.9	44.4	47.3	43.7	40.1
44's	44	4.25	38.7	33.7	36.3	34.9	25.2
		4.50	38.7	33.9	33.7	33.8	25.9
		4.75	37.2	32.8	33.3	33.1	25.6
		Average.	38.2	33.5	34.4	33.9	25.6

The different varieties arranged in the order of their strength values, after allowing for the difference in the length of staple of the cotton, are as follows (strongest at top of list):

1. {Acala..... / Mexican Big Boll..} equal.
2. {Lone Star..... / Rowden.....} equal.
3. Typical North Georgia.

IRREGULARITY OF YARNS.

The irregularity of the yarn was determined by calculating the average deviation of the sizings and breaking strengths per skein of 120 yards.

Table 6 gives the percentages of average deviation in the sizings per skein of 120 yards.

TABLE 6.—*Irregularity or average deviation in the sizings of the yarn.*

No. of yarn.	Acala.	Lone Star.	Mexican Big Boll.	Rowden.	Typical North Georgia.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
28's..	2.02	2.02	2.11	2.01	1.94
36's..	2.06	2.06	2.18	1.79	2.10
44's..	2.40	1.87	2.16	2.17	1.81

Table 6 shows that the yarns made from the different varieties of cotton were practically equal in evenness.

Table 7 gives the percentages of average deviation in the breaking strength per skein of 120 yards.

TABLE 7.—*Irregularity or average deviation in the breaking strengths of the yarn.*

No. of yarn.	Acala.	Lone Star.	Mexican Big Boll.	Rowden.	Typical North Georgia.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
28's	4.54	3.72	4.72	4.72	3.74
36's	4.51	3.86	5.09	3.98	3.86
44's	4.58	5.30	5.27	5.70	6.29

The different varieties arranged in order of evenness of strength are as follows:

1. Lone Star.
2. {Acala..... / Typical North Georgia..} equal.
3. Rowden.
4. Mexican Big Boll.

MANUFACTURING PROPERTIES.

No difficulty was encountered in running any of the varieties, all showed excellent spinning qualities.

SUMMARY.

The cottons tested were from the crop of 1921, and consisted of the fiber of the following varieties: Acala, Lone Star, Mexican Big Boll, Rowden, and of typical cotton of the kind commercially known as "North Georgia." The Acala cotton was grown in Alabama, the Lone Star, Mexican Big Boll and Rowden were grown at different points in North Carolina, and the typical North Georgia cotton was grown in "North Georgia."

All of the cottons were tested under identical mechanical conditions.

The grades, lengths of staple, percentages of visible waste, strengths of the yarns, and percentages of average deviation or irregularity of the sizings and strengths as shown in Table 8, indicate that for hard twisted or warp yarns the varieities tested if placed in order of their merit and attractiveness from a spinner's viewpoint would fall in the following rank:

1. {Acala, Mexican Big Boll} equal.
2. {Lone Star, Rowden} equal.
3. Typical North Georgia.

TABLE 8.—*Grades, lengths of staple, percentages of visible waste, strengths of the yarn, and percentages of average deviation of the sizings and strengths of the yarn.*

	Acala.	Lone Star.	Mexican Big Boll.	Rowden.	Typical North Georgia.
Grade	Mid.	S. M.	G. M.	G. M.	S. M.
Length of staple (inches)	1 1/16	1 1/16	1 full.	1 1/16	1 1/16
Percentage of visible waste	8.28	7.54	6.71	5.97	6.29
Strength of yarn in pounds per skein of 120 yards:					
28's	70.5	62.3	67.2	63.5	56.4
36's	49.9	44.4	47.3	43.7	40.1
44's	38.2	33.5	34.4	33.9	25.6
Percentage of average deviation or irregularity of sizing of the yarn:					
28's	2.02	2.02	2.11	2.01	1.94
36's	2.06	2.06	2.18	1.79	2.10
44's	2.40	1.87	2.16	2.17	1.81
Percentage of average deviation or irregularity of strength of the yarn:					
28's	4.54	3.72	4.72	4.72	3.74
36's	4.51	3.86	5.09	3.98	3.86
44's	4.58	5.30	5.27	5.70	6.29

These tests show clearly the desirability, from a spinning standpoint, of fiber produced by purebred strains of superior varieties of cotton over that produced from commercial seed even when grown in districts in which the reputation for character in cotton is excellent.